Remarks

The Office Action dated has been received and reviewed. Claims 1, 4-6, 13, and 16-17 have been amended. Claims 25-44 have been added. The pending claims are claims 1-44. Reconsideration and withdrawal of the rejections are respectfully requested.

Claim Amendments

Claim 1 was amended to recite that the spatial filter is positioned at a plane of an exit pupil of the objective lens. Support for this amendment may found in the Specification, e.g., at page 10, lines 1-5.

Claims 4-6 were amended to be consistent with amended claim 1.

Claim 13 was amended to recite spatial filtering at least a portion of the incident light or the reflected light using a spatial filter at a plane of an exit pupil of the objective lens. Support for this amendment may be found in the Specification, e.g., at page 10, lines 1-5.

Claims 16-17 were amended to be consistent with amended claim 13.

New Claims

Claims 25-44 were added to more distinctly claim the present invention. No new matter was added.

The 35 U.S.C. § 102(b) Rejection

The Examiner rejected claims 1, 7, 9, 13-14, 18-20, and 24 under 35 U.S.C. § 102(b) as being anticipated by Willenborg et al. (U.S. Patent No. 5,159,412). Applicants traverse this rejection.

However, to further move this case towards issuance, Applicants have amended claims 1 and 13 as described above.

Applicants submit that claims 1, 7, 9, 13-14, 18-20, and 24 are not anticipated by Willenborg et al. for at least the following reasons. For a claim to be anticipated under 35 U.S.C. § 102(b), each and every element of the claim must be found in a single prior art

reference. *See* M.P.E.P. § 2131.

Applicants submit that Willenborg et al. does not teach each and every element of claims 1, 7, 9, 13-14, 18-20, and 24. For example, amended claim 1 recites a spatial filter to modify at least a portion of the incident light or the reflected light, wherein the spatial filter is positioned at a plane of an exit pupil of the objective lens. Planes of the exit pupil of the objective lens include the actual plane (e.g., actual plane 39 of the objective lens 32 in FIG. 2), or a conjugate plane in the analyzer arm of the ellipsometer apparatus (e.g., conjugate plane 106 of the exit pupil of objective lens 70 in FIG. 4). Further, a plane of the exit pupil of the objective lens may also include a conjugate plane in the illumination source (e.g., conjugate plane 126 of the exit pupil of objective lens 70 in FIG. 5). Further, amended claim 13 recites spatial filtering at least a portion of the incident light or the reflected light using a spatial filter at a plane of an exit pupil of the objective lens.

In contrast to claims 1 and 13, Willenborg et al. teaches a blocking member 70 (i.e., the alleged spatial filter) that is located in the focal plane of the relay lens 68. In other words, Willenborg et al. does not place blocking member 70 at a plane of the objective lens 62. This teaching is in direct contrast to claims 1 and 13 where the spatial filter is positioned at a plane of the exit pupil of the objective lens. The present invention places the spatial filter at a plane of the exit pupil of the objective lens so that it may be used to break the azimuth symmetry and allow for extraction of phase delay information. *See*, e.g., Specification, page 13, lines 6-7. Willenborg et al., on the other hand, utilizes blocking member 70 to filter any spurious laser light that is scattered by either the optics of the system or the sample itself. *See* Willenborg et al., column 4, lines 19-21. The blocking member 70 will perform its blocking function only if placed in the focal plane of the relay lens 68; it would be unobvious to one skilled in the art to place the blocking member 70 at a plane of the exit pupil of the objective lens in Willenborg et al. because such placement would change the principle of operation of the disclosed device. Therefore, Willenborg et al. does not teach each and every element of claims 1 and 13.

Claims 7, 9, 14, 18-20, and 24, each of which depend, either directly or ultimately, from one of independent claims 1 or 13, are not anticipated by Willenborg et al. for the same reasons

as presented above for claims 1 and 13. In addition, claims 7, 9, 14, 18-20, and 24 each recite additional elements that further support patentability when combined with claim 1 or 13.

For at least the above reasons, Applicants submit that claims 1, 7, 9, 13-14, 18-20, and 24 are not anticipated by Willenborg et al. Reconsideration and withdrawal of this rejection are, therefore, respectfully requested.

The 35 U.S.C. § 103(a) Rejection

The Examiner rejected claims 2-6, 8, 10-12, 15-17, and 21-23 under 35 U.S.C. § 103(a) as being unpatentable over Willenborg et al. in view of Ghislain et al. (U.S. Patent No. 5,939,709).

Applicants traverse this rejection and submit that claims 2-6, 8, 10-12, 15-17, and 21-23 are not *prima facie* obvious for at least the following reasons. To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art references must teach or suggest all the claim limitations. *See* M.P.E.P. § 2143.

Applicants submit that claims 2-6, 8, 10-12, 15-17, and 21-23 are not *prima facie* obvious because the combination of Willenborg et al. and Ghislain et al. does not teach every element of such claims. For example, claims 2-6, 8, and 10-12 depend from independent claim 1 and, therefore, include all of the elements of claim 1. As stated above in regard to the 35 U.S.C. § 102(b) rejections, amended claim 1 recites that the spatial filter is positioned at a plane of an exit pupil of the objective lens. Claim 13, from which claims 15-17 and 21-23 depend, recites spatial filtering at least a portion the incident light or the reflected light using a spatial filter at a plane of an exit pupil of the objective lens.

In the present invention, the spatial filter is used to extract phase information with regard to the polarization effects due to Fresnel reflection with the high numerical aperture objective lens. *See*, e.g., Specification, page 10, lines 1-5. Without a spatial filter, i.e., when the whole

aperture is used, information on phase delay would be substantially zero because of the symmetry of the phase information regarding the reflected light from the sample. *See*, e.g., Specification, page 13, lines 3-6. The spatial filter is used to break the azimuth symmetry and allow for extraction of the phase delay information. *See id.* at page 13, lines 6-7.

As stated above in regard to the 35 U.S.C. § 102(b) rejection, Willenborg et al. does not teach the above-mentioned elements of claims 1 and 13. The addition of Ghislain et al. does nothing to cure this deficiency already present in Willenborg et al. For example, Ghislain et al. teaches that filters 32a-32c can be added to the disclosed scanning probe microscope. However, Ghislain et al. does not teach that any of filters 32a-32c are located at a plane of an objective lens as is recited in claims 1 and 13. The Examiner further alleges that Ghislain et al. teaches that the filter 32a can be located next to the objective lens (30) as shown in FIG. 3B. Applicants submit that while Ghislain et al. may show some sort of filter 32a as being proximate focusing lens 30, Ghislain et al. does not teach a spatial filter positioned at <u>a plane</u> of an exit pupil of the objective lens.

For at least the above reasons, Applicants submit that claims 2-6, 8, 10-12, 15-17, and 21-23 are not *prima facie* obvious. Reconsideration and withdrawal of this rejection are, therefore, respectfully requested.

Summary

It is respectfully submitted that the pending claims are in condition for allowance and notification to that effect is respectfully requested. The Examiner is invited to contact Applicants' Representatives, at the below-listed telephone number, if it is believed that prosecution of this application may be assisted thereby.

Respectfully submitted for
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CERTIFICATE UNDER 37 C.F.R. §1.10:
"Express Mail" mailing label number: EV 073734387 US Date of Deposit: October 7, 2002
The undersigned hereby certifies that this paper is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. §1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

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APPENDIX A - CLAIM AMENDMENTS
INCLUDING NOTATIONS TO INDICATE CHANGES MADE
Serial No.: 09/691,006
Docket No.: 110.0142 0101

Amendments to the following are indicated by underlining what has been added and bracketing what has been deleted.

In the Claims

For convenience, all pending claims are shown below.

1. **(Once Amended)** An ellipsometer apparatus for use in providing an image of at least a portion of a sample, the ellipsometer apparatus comprising:

an objective lens having a focal plane at which a sample plane of the sample is positioned;

an illumination source for providing incident light normal to the sample plane, wherein the incident light comprises linearly polarized light incident on the objective lens, wherein the objective lens focuses the incident linearly polarized light onto the sample, and further wherein at least a portion of the focused incident polarized light is reflected by the sample resulting in reflected light;

a spatial filter to modify at least a portion of the incident light or the reflected light, <u>wherein the spatial filter is positioned at a plane of an exit pupil of the objective lens</u>; and

an analyzer portion operable to generate polarization information based on the reflected light.

2. The apparatus of claim 1, wherein the illumination source comprises a fiber illuminator.

3. The apparatus of claim 1, wherein the objective lens is a high numerical aperture objective lens having a numerical aperture in the range of 0.5 to less than 1.

4. **(Once Amended)** The apparatus of claim 1, wherein the spatial filter is positioned adjacent the objective lens in an actual plane of [an]<u>the</u> exit pupil thereof.

5. **(Once Amended)** The apparatus of claim 1, wherein the spatial filter is part of the

illumination source and is positioned in a conjugate plane of [an]<u>the</u> exit pupil of the objective lens.

6. **(Once Amended)** The apparatus of claim 1, wherein the spatial filter is part of the analyzer portion and is positioned in a conjugate plane of [an]<u>the</u> exit pupil of the objective lens.

7. The apparatus of claim 1, wherein the analyzer portion comprises:

a rotatable quarter wave plate;

an analyzer;

a lens; and

a detector, wherein the rotatable quarter wave plate, the analyzer, and the lens are positioned such that the reflected light passes through the rotatable quarter wave plate and the analyzer, and further wherein the reflected light is focused onto the detector by the lens.

8. The apparatus of claim 7, wherein the detector is a charge coupled device array detector.

9. The apparatus of claim 1, wherein the apparatus further comprises a beam splitter for passing the linearly polarized light normal to the sample plane and incident on the objective lens, and further wherein the beam splitter diverts the reflected light to the analyzer portion.

10. The apparatus of claim 1, wherein the illumination source comprises a polarization converter providing for linearly polarized light with polarization states that are at +/- 45 degrees with respect to an incident plane of the linearly polarized light, and wherein the analyzer portion comprises a polarization device matched to the polarization converter of the illumination source.

11. The apparatus of claim 1, wherein the spatial filter is configured such that the polarization state of the light that is modified thereby is aligned at 45 degrees with respect to an incident plane of the linearly polarized light.

12. The apparatus of claim 1, wherein the illumination source includes a thin filament bulb and a low numerical aperture lens for use in projecting an image of the filament onto the sample and is operable to sweep the image across the sample.

13. **(Once Amended)** An ellipsometry method for use in providing an image of at least a portion of a sample, the method comprising:

providing an objective lens having a focal plane at which a sample plane of the sample is positioned;

providing linearly polarized light normal to the sample plane incident on the objective lens;

focusing the incident linearly polarized light onto the sample, wherein at least a portion of the focused incident polarized light is reflected by the sample resulting in reflected light;

spatial filtering at least a portion of the incident light or the reflected light using a spatial filter positioned at a plane of an exit pupil of the objective lens; and

generating polarization information based on the reflected light.

14. The method of claim 13, wherein providing linearly polarized light normal to the sample plane incident on the objective lens comprises:

providing light from an extended source;

collimating the light; and

linearly polarizing the collimated light.

15. The method of claim 13, wherein the objective lens is a high numerical aperture objective lens having a numerical aperture in the range of 0.5 to less than 1.

16. **(Once Amended)** The method of claim 13, wherein spatial filtering at least a portion of the incident light or the reflected light comprises using a spatial filter at [a]an actual plane of [an]the exit pupil of the objective lens.

17. **(Once Amended)** The method of claim 13, wherein spatial filtering at least a portion of the incident light or the reflected light comprises using a spatial filter at a conjugate plane of [an]the exit pupil of the objective lens.

18. The method of claim 13, wherein generating polarization information based on the reflected light comprises:

passing the reflected light through an analyzer portion comprising at least a rotatable quarter wave plate and an analyzer;

rotating at least the rotatable quarter wave plate to at least two angular positions;

detecting at least two polarization images corresponding to the at least two angular positions.

19. The method of claim 18, wherein generating polarization information based on the reflected light further comprises generating an image using at least one of a ratio and a difference of the at least two polarization images.

20. The method of claim 18, wherein the method further comprises:

rotating the analyzer of the analyzer portion to one or more positions; and

generating additional polarization images corresponding to the one or more positions.

21. The method of claim 13, wherein providing linearly polarized light normal to the sample plane incident on the objective lens comprises providing linearly polarized light with polarization states that are at +/- 45 degrees with respect to an incident plane of the linearly polarized light using a polarization converter, and further wherein generating polarization

information based on the reflected light comprises generating polarization information based on the reflected light using a polarization device matched to the polarization converter.

22. The method of claim 13, wherein spatial filtering at least a portion of the incident light or the reflected light comprises providing a spatial filter configured such that the polarization state of the light that is modified thereby is aligned at 45 degrees with respect to an incident plane of the linearly polarized light incident on the objective lens.

23. The method of claim 22, wherein generating polarization information based on the reflected light comprises:

passing the reflected light through an analyzer portion comprising at least a rotatable quarter wave plate and an analyzer; and

synchronously rotating the rotatable quarter wave plate, the analyzer, and the spatial filter to obtain a plurality of polarization images.

24. The method of claim 13, wherein providing linearly polarized light normal to the sample plane incident on the objective lens comprises providing light such that an illumination line is focused on the sample, and further wherein the method comprises sweeping the illumination line across the sample.

25. **(New)** <u>The apparatus of claim 1, wherein the spatial filter is operable to break the azimuth symmetry of the incident light or the reflected light.</u>

26. **(New)** <u>The apparatus of claim 2, wherein the fiber illuminator comprises a light source and a fiber bundle.</u>

27. **(New)** <u>An ellipsometer apparatus for use in providing an image of at least a portion of a sample, the ellipsometer apparatus comprising:</u>

an objective lens having a focal plane at which a sample plane of the sample is positioned;

an illumination source comprising an extended light source for providing incident light normal to the sample plane, wherein the incident light comprises linearly polarized light incident on the objective lens, wherein the objective lens focuses the incident linearly polarized light onto the sample, and further wherein at least a portion of the focused incident polarized light is reflected by the sample resulting in reflected light;

a spatial filter to modify at least a portion of the incident light or the reflected light, wherein the spatial filter is operable to break the azimuth symmetry of the incident light or the reflected light; and

an analyzer portion, wherein the analyzer portion is operable to generate polarization information based on the reflected light for use in generating an image of at least a portion of the sample using the polarization information.

28. **(New)** The apparatus of claim 27, wherein the extended light source comprises a light source and a fiber bundle.

29. **(New)** The apparatus of claim 27, wherein the spatial filter is positioned adjacent the objective lens in an actual plane of an exit pupil thereof.

30. **(New)** The apparatus of claim 27, wherein the spatial filter is part of the illumination source and is positioned in a conjugate plane of an exit pupil of the objective lens.

31. **(New)** The apparatus of claim 27, wherein the spatial filter is part of the analyzer portion and is positioned in a conjugate plane of an exit pupil of the objective lens.

32. **(New)** The apparatus of claim 27, wherein the analyzer portion comprises:

a rotatable quarter wave plate;

an analyzer;

a lens; and

a detector, wherein the rotatable quarter wave plate, the analyzer, and the lens are positioned such that the reflected light passes through the rotatable quarter wave plate and the analyzer, and further wherein the reflected light is focused onto the detector by the lens.

33. **(New)** The apparatus of claim 27, wherein the illumination source comprises a polarization converter providing for linearly polarized light with polarization states that are at +/- 45 degrees with respect to an incident plane of the linearly polarized light, and wherein the analyzer portion comprises a polarization device matched to the polarization converter of the illumination source.

34. **(New)** The apparatus of claim 27, wherein the spatial filter is configured such that the polarization state of the light that is modified thereby is aligned at 45 degrees with respect to an incident plane of the linearly polarized light.

35. **(New)** An ellipsometry method for use in providing an image of at least a portion of a sample, the method comprising:

providing an objective lens having a focal plane at which a sample plane of the sample is positioned;

providing linearly polarized light normal to the sample plane incident on the objective lens, wherein providing linearly polarized light comprises providing light from an extended light source;

focusing the incident linearly polarized light onto the sample, wherein at least a portion of the focused incident polarized light is reflected by the sample resulting in reflected light;

spatial filtering at least a portion of the incident light or the reflected light, wherein spatial filtering at least a portion of the incident light or reflected light comprises breaking the azimuth symmetry of the incident light or the reflected light;

generating polarization information based on the reflected light; and

providing an image of at least a portion of the sample using the polarization information.

36. **(New)** The method of claim 35, wherein providing linearly polarized light normal to the sample plane incident on the objective lens further comprises:

collimating the light provided by the extended light source; and

linearly polarizing the collimated light.

37. **(New)** The method of claim 35, wherein spatial filtering at least a portion of the incident light or the reflected light comprises using a spatial filter at a plane of an exit pupil of the objective lens.

38. **(New)** The method of claim 35, wherein spatial filtering at least a portion of the incident light or the reflected light comprises using a spatial filter at a conjugate plane of an exit pupil of the objective lens.

39. **(New)** The method of claim 35, wherein generating polarization information based on the reflected light comprises:

passing the reflected light through an analyzer portion comprising at least a rotatable quarter wave plate and an analyzer;

rotating at least the rotatable quarter wave plate to at least two angular positions; and

detecting at least two polarization images corresponding to the at least two angular positions.

40. **(New)** The method of claim 39, wherein generating the image comprises generating the image of at least a portion of the sample using at least one of a ratio and a difference of the at least two polarization images.

41. **(New)** The method of claim 40, wherein the method further comprises:

rotating the analyzer of the analyzer portion to one or more positions; and

generating additional polarization images corresponding to the one or more positions.

42. **(New)** The method of claim 35, wherein providing linearly polarized light normal to the sample plane incident on the objective lens comprises providing linearly polarized light with polarization states that are at +/- 45 degrees with respect to an incident plane of the linearly polarized light using a polarization converter, and further wherein generating polarization information based on the reflected light comprises generating polarization information based on the reflected light using a polarization device matched to the polarization converter.

43. **(New)** The method of claim 35, wherein spatial filtering at least a portion of the incident light or the reflected light comprises providing a spatial filter configured such that the polarization state of the light that is modified thereby is aligned at 45 degrees with respect to an incident plane of the linearly polarized light incident on the objective lens.

44. **(New)** The method of claim 43, wherein generating polarization information based on the reflected light comprises:

passing the reflected light through an analyzer portion comprising at least a rotatable quarter wave plate and an analyzer; and

synchronously rotating the rotatable quarter wave plate, the analyzer, and the spatial filter to obtain a plurality of polarization images.